On Anoplocephalidae (Cestoda), parasitizing Rodentia and Lagomorpha in Europe

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Over the last few years, a new debate has arisen about the genus and species evaluation of tapeworms belonging to the family Anoplocephalidae and parasitizing Rodentia and Lagomorpha. The problem concerns namely the genera Andrya Railliet, 1893, Paranoplocephala Lühe, 1910, and Anoplocephaloides Baer, 1923.

In our paper we will present the results acquired recently in joint investigations of this problem. For our conclusion we had at our disposal tapeworms from the Palaearctic region (all species described in Europe), the Nearctic region (2 species), and the Aethiopian region (3 species). To give a total survey we wish to state that, at the present time, a total number of 46 tapeworm species has been described of the abovementioned genera, of which 13 are parasites known from rodents and lagomorphs in Europe. Out of these 13 species, 2 belonging to the genus Andrya, 6 to the genus Paranoplocephala, and 5 to Anoplocephaloides.

As concerning the species known from Europe, they are parasitic species zoogeographically very specific and are significantly specialized as regards their host (or group of hosts). Not one of them has been found to parasitize outside the Palaearctic region. Exceptions are some species originally described in Europe, which also appeared in America (P. omphalodes) or parasites of lagomorphs introduced there with their hosts. On the one hand, also the species P. ondatrae was introduced 80 years ago with muskrats into Europe where it found favourable conditions for its existence. As a host it is limited to Ondatra zibethicus only. On the other hand, the species found in the Neartic region were recorded only sporadically in the easternmost part of the USSR, where they are probably not native species. Extremely specific are tapeworm species known from lagomorphs in the Neotropic region. They have their own striking morphological peculiarities (a body thickly covered with chitinous spines). One

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species of this kind - *Anoplocephaloides pseudowimerosa* - was probably introduced from South America to Spain. Quite specific are tapeworm species parasitizing endemic rodents in Africa; they have not yet been found on any other continent.

Comparisons of material and the known zoogeographical data showed that the species of the Palaearctic and Nearctic regions parasitizing rodents are evidently the most closely related. On the other hand, there are significant morphological differences among tapeworms parasitizing lagomorphs in the Palaearctic and Neotropic regions.

**RESULTS**

As far as taxa at the generic level are concerned, it is necessary to state the following:

I. *Andrya* Railliet, 1893

The oldest genus is *Andrya* Railliet, 1893. It is one of the genera about the existence of which there has never been any doubt, even though, for a short period, some authors (i.e. TENORA and MURAI, 1980) considered it to be a monotypical genus. The species spectrum of this genus as given in present literature is very heterogenous. Originally, the genus *Andrya* was retained for 2 tapeworm species parasitizing Lagomorpha in the Palaearctic region, viz. *A. rhopalocephala* and *A. cuniculi*. The main generic criterion is considered to be what is called the presence of "prostatic gland". While there is no doubt as to the validity of the genus, there is some doubt (sometimes rightful) as to which other species (in addition to the already mentioned *A. rhopalocephala* and *A. cuniculi*) belong to the genus *Andrya* (e.g. the species described from DOUTHITT, 1915). Also, e.g. KIRCHENBLAT (1938) and later SPASSKY (1951) studied some species of the genus *Andrya* parasitizing rodents. They state that not all of them have a well developed "prostatic gland". To accommodate such species, they formed a new subgenus, later genus: *Aprostatandrya*. More recently, RAUSCH (1976) and TENORA et al. (1981-1982) have returned to this problem and, on the basis of investigations of a broad spectrum of tapeworms, they came to the conclusion that the so-called "prostatic gland" is, in fact, the vesicula seminalis externa which has a more or less structurally different surface in the particular stages of its activity. On the "in toto" preparations, this structure of the surface of the vesicula seminalis externa gives to impression that these tapeworms, compared with others, have some extra organs. However, the character and structure of the vesicula seminalis externa is similar also in the genera *Paranoplocephala* and *Anoplocephaloides*, but in preparations that are not of good quality, it may not always be well observed.

The question therefore arises which morphological and anatomical features characterize the genus *Andrya* most expressively. RAUSCH (1976) cogitates that such a character could be the development of the uterus. TENORA et al. (1981-82) studied the development of the uterus of a typical species, *A. rhopalocephala*, and they came to the conclusion that, in principle, it does not differ from the development and character of the uterus of the species *P. omphalodes* (which is a typical species of the genus *Paranoplocephala*).

When evaluating all the known facts, we came to the conclusion that the subgenus *Aprostatandrya* Kirschchenblat, 1938 is a synonym of the genus *Paranoplocephala* Lühe, 1910. We can further state that, according to our investigations, 2 species belong to the genus *Andrya*, viz. *A. cuniculi* (Blanchard, 1891) and *A. rhopalocephala* (Riehm, 1881). They are species morphologically well differentiated, vicarious. The species *A. cuniculi* parasitizes Lagomorpha in western Europe, the species *A. rhopalocephala* in central and eastern Europe and central Asia. The species *A. cuniculi* has been introduced to the U.S.A. It is not excluded that to the genus *Andrya* also belong some tapeworm species originally described in *Andrya* or other genera like parasites of Rodentia in the Nearctic region. Unfortunately, the development of the uterus of such species has not been studied in detail.

Both of the species of the genus *Andrya* mentioned above can be characterized by their special development of the uterus. In the beginning it is an aggregation of cells near the ovary. In the mature segments, still during the full activity of the testes and other genital organs,
the uterus suddenly forms the processes which proliferate among the testes from the ventral, dorsal and lateral sides, at the same time forming an uterus of a network type. As has been stressed, the transition from a cell aggregation type of uterus to a network one, is very quick and sudden, is in this way typical for the species of the genus Andrya (see e.g. SPASSKY, 1951a). It was also found that organs such as the vagina, receptaculum seminis, cirrus sac with vesicula seminalis externa are sizeably developed also in the last gravid segments which are completely filled with mature eggs.

II. Paranoplocephala Lühe, 1910

Another genus which was in the foreground of our studies is the genus Paranoplocephala Lühe, 1910. This genus was constituted by LÜHE for only one tapeworm species - P. omphalodes (Hermann, 1783) (previously ranked among the genus Anoplocephala Blanchard, 1848). Regrettably, LÜHE never saw the species P. omphalodes. He took both the diagnosis of this species and its pictures from the publication of STIEDA (1862). In addition, he drew the picture of the uterus incorrectly and thus formed a completely false impression about the species P. omphalodes (see TENORA and MURAI, 1980). Even in spite of this fact it is interesting that, with the exception of LÓPEZ-NEYRA (1954) who considered the genus Paranoplocephala as a subgenus of the genus Anoplocephala only, up till 1976 (i.e. till the publication of RAUSCH, 1976) none of the leading taxonomists had any doubts that the genus Paranoplocephala was a bona genus. And, out of the present 19 species which are now included into the genus Paranoplocephala, only 4 species were originally described for the genus Paranoplocephala, viz. P. omphalodes, P. kirbyi, P. gracilis, and P. mascomai. Others were originally described for the genus Andrya or Aprostatandrya, only exceptionally Anoplocephala, and then gradually transferred to the genus Paranoplocephala. As has already been mentioned above, basing also on our results, it is necessary to agree with the opinion of RAUSCH (1976) that the genus Aprostatandrya is a synonym of Paranoplocephala.

Present studies on the development of the uterus of the species P. omphalodes (a typical species of the genus Paranoplocephala) does shown that there is a considerable affinity with the development of the uterus of the species Andrya rhopalocephala (a typical species of the genus Andrya) but, there are also certain differences. In essence, the development is basically the same - a network in gravid segments. On the contrary, in Paranoplocephala from the maternal sacciform uterus, the processes proliferate gradually from the dorsal, ventral and lateral sides. However, the processes do not form a network structure suddenly, rapidly among the active testes (like in Andrya) but gradually among the forming eggs. The gravid uterus in the genus Paranoplocephala is virtually of the same network structure as in species of the genus Andrya. The only difference is that the transition from a sacciform uterus to a network uterus is gradual, reticulation developing later. Neither are the receptaculum seminis, vesicula seminalis or the other organs always functional in the fully gravid segments.

Despite the facts given about the considerable affinity of the development of the uterus of the genus Paranoplocephala and Andrya we leave (contrary to TENORA et al. in press), the genus Paranoplocephala is a bona genus. It consists of a total of 19 described species of which all are exclusively parasites of rodents. It is not excluded that some species arranged in Paranoplocephala are in fact Andrya. The development of the uterus of some Andrya or Paranoplocephala parasitizing rodents is not known in detail.

III. Anoplocephaloides Baer, 1923

The last genus which we investigated is Anoplocephaloides Baer, 1923. However, BAER himself, as early as in 1927, came to the opinion that the genus Anoplocephaloides which he himself described, is a synonym of Paranoplocephala Lühe, 1910; later (1949) that it is a subgenus of Paranoplocephala. Therefore, the genus Paranoplocephala (as mentioned above) consists of tapeworms often morphologically different. For nearly half a century, till the publication of the study of RAUSCH (1976), there was no doubt about the statement that the genus Anoplocephaloides is a synonym of the genus Paranoplocephala. RAUSCH (1976) repeatedly substantiated the independence of the genus Anoplocephaloides and placed several species into this genus, referred in the past of the genus Paranoplocephala. As the principle criterion, he gave the development of the uterus.
In the present material we were able to study the development of the uterus in some species of the genus Anoplocephaloides, viz. A. dentata, A. wimerosa, A. pseudowimerosa, A. iso­mydis and A. acanthocirrosa. We can state that at the beginning of its development the uterus of the genus Anoplocephaloides is a sacciform formation, developing over the testes. This formation suppresses the testes relatively quickly. The branches of the uterus form the mat­ernal envelope of the uterus, proliferate into the interior of the uterus, namely from the dor­sal and ventral sides. In contradistinction to the genera Andrya and Paranoplocephala, they do not form an intertwined network within the uterus. The sacciform uterus (often also the uterus in the fully gravid segments) forms a lumen inside of which the eggs are deposited. During more detailed studies of this type of uterus we came to the conclusion that during its development, especially in the initial stages, it is very similar to the uterus of the genus Paranoplocephala. In extreme cases it is different, but in the course of development it is re­lated. Similarly as for the genus Paranoplocephala, we leave the genus Anoplocephaloides at the present time, as a bona genus. It consists of 20 tapeworm species parasitizing Rodentia, Lagomorpha and Perissodactyla.

**REVIEW* OF ANDRYA, PARANOPLOCEPHALA AND ANOPLOCEPHALOIDES**

1. **Genus: Andrya Railliet, 1893**
   Type species: Andrya rhopalocephala (Riehm, 1881)<x>+
   Other species:
   Andrya cuniculi (Blanchard, 1891)<x>+

2. **Genus: Paranoplocephala Lühe 1910<o>**
   Syn.: Aprostatandrya Kirschenblat, 1938
   Type species: Paranoplocephala omphalodes (Hermann, 1783)<x>+
   Other species:
   P. blanchardi (Moniez, 1891)<x>+, P. macrocephala (Douthitt, 1915), P. translucida (Douth­itt, 1915), P. primordialis (Douthitt, 1915), P. communis (Douthitt, 1915), P. gundii (Joyeux, 1923)<x>, P. caucasica (Kirschenblat, 1938)<x>+, P. montana (Kirschenblat, 1941), P. neotomae (Voge, 1946), P. sciuri (Rausch, 1947), P. microti (Hansen, 1947), P. on­datrae (Rausch, 1948)<x>+, P. kirbyi Voge, 1948, P. arctica (Rausch, 1952), P. bairdi (Schad, 1953), P. dasydimis (Hunkeler, 1972), P. gracilis Tenora et Murai, 1980<x>+, P. mascomai Murai, Tenora et Rocamora, 1980<x>+

3. **Genus: Anoplocephaloides Baer, 1923**
   Type species: A. infrequens (Douthitt, 1915)
   Other species:

4. **Species which taxonomic status is uncertain**
Paranoplocephala forcipata (Linstow, 1904), Andrya bialowiezensis Soltys, 1949<x>+, Par-

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*x* Review of the species is done without reference to synonyms, nomen nudum or species in­quirenda.

<x> species studied personally

+y species known in Europe

<o> it is not excluded, that some species arranged in Paranoplocephala are Andrya, because not in all cases is the development of uterus studied in detail. From this point of view the genus Paranoplocephala has a provisional species spectrum.
anoplocephala campestris Cholodkowski, 1912\textsuperscript{1}), Paranoplocephala otomyos Collins, 1972, Aprostatandrya octodonensis Babero et Cattan, 1975.

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REFERENCES


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